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WO 95/15131 A1 WO 95/07509 A1 US 5370692 A
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(54) Abstract Title
Prosthetic implants

(57) An implant 12 for replacing bone, particularly jaw bone, is made by scanning a part of the patient's bone structure and building up a 3D image thereof (which may be used to make a resin model), calculating the portion of the structure that is to be replaced and making the implant to the desired shape. The implant may include attachments 34 for teeth or means for attaching a further implant such as dentures. The implant may be attached to bone or to a further implant part by means of a plate 13 and threaded screws 28 and bolts 30, the screws having slits 33 and threaded openings at their free ends such that, when the bolts are threaded therein, the ends of the screws are urged outwardly. Also disclosed are various surgical saw guide arrangements (Figs.10-13 - not shown).

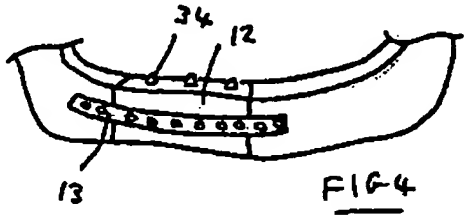

FIG 4

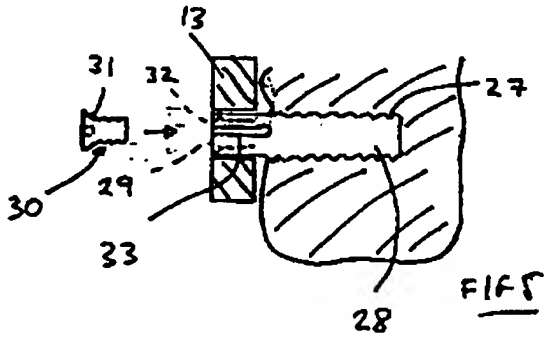

FIG 5

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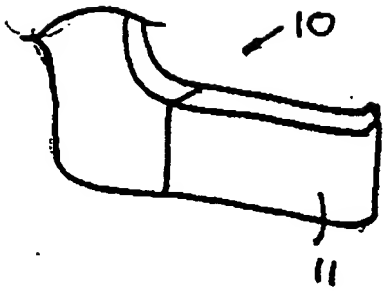

FIG-1

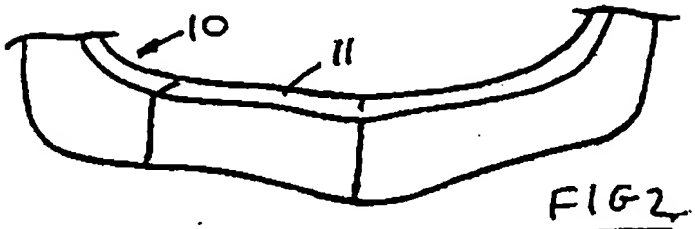

FIG-2

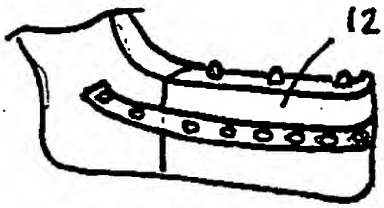

FIG-3

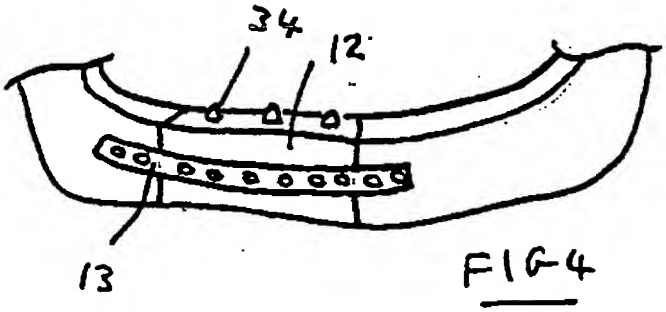

FIG-4

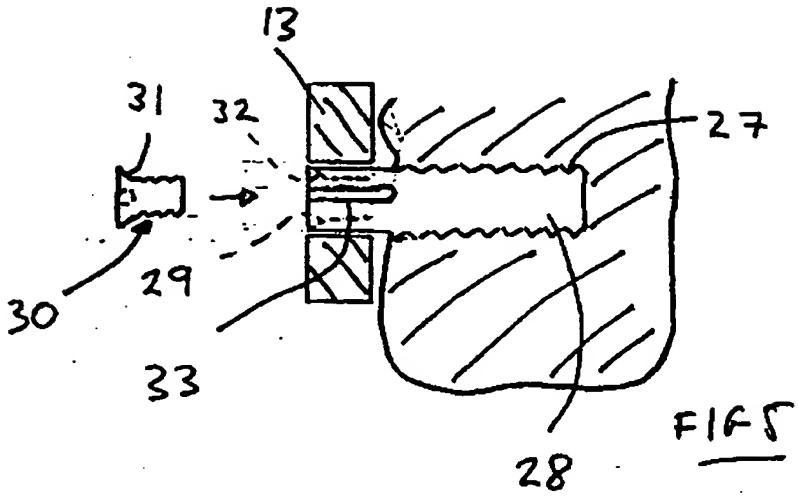

FIG 5

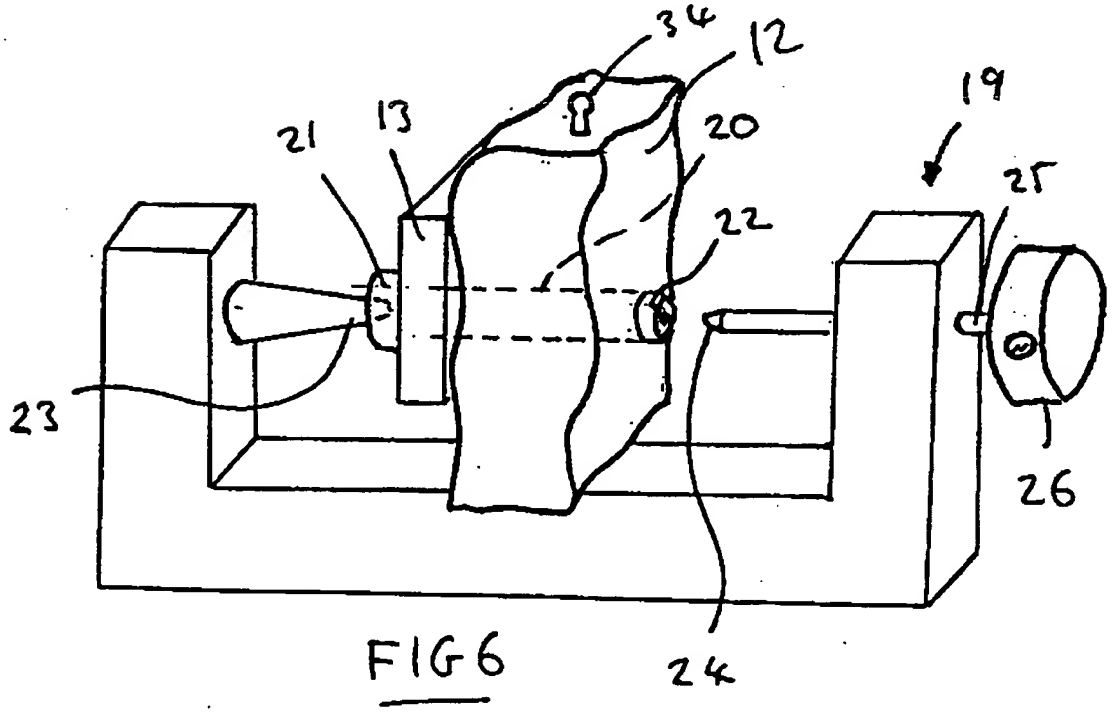

FIG 6

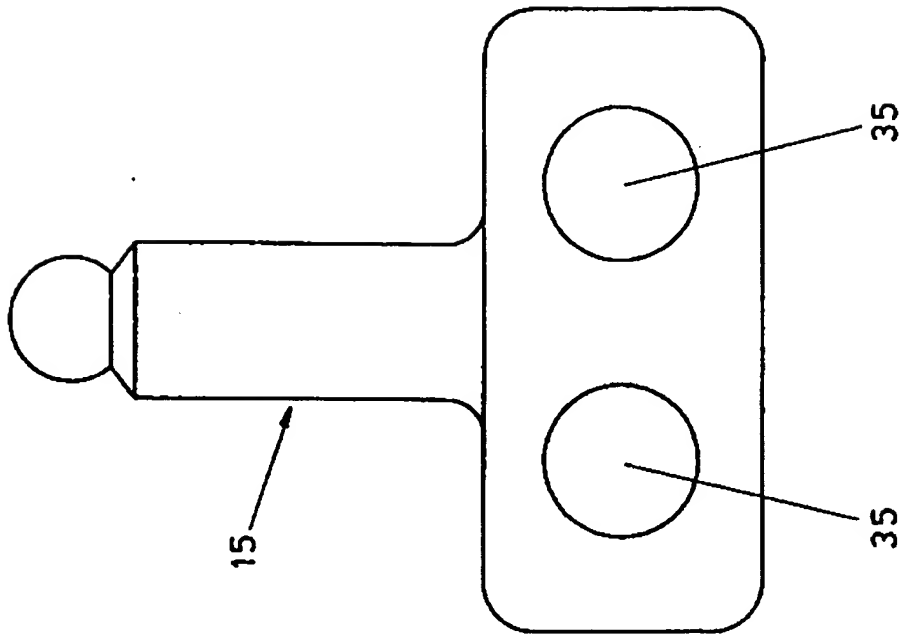

FIG. 7B

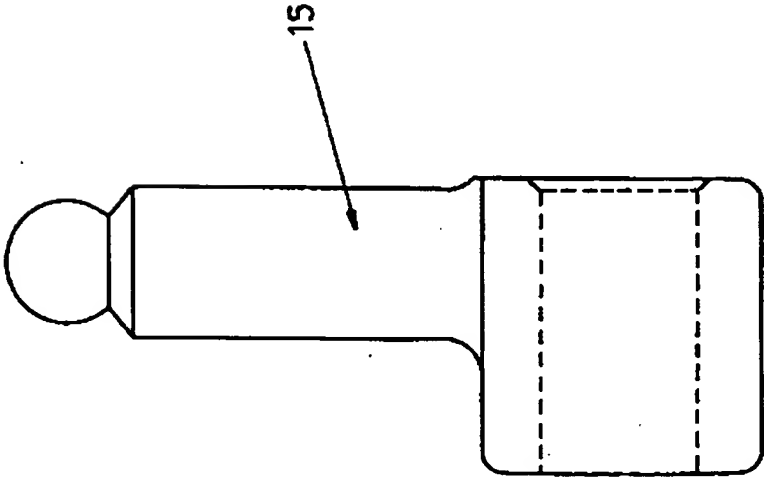

FIG. 7A

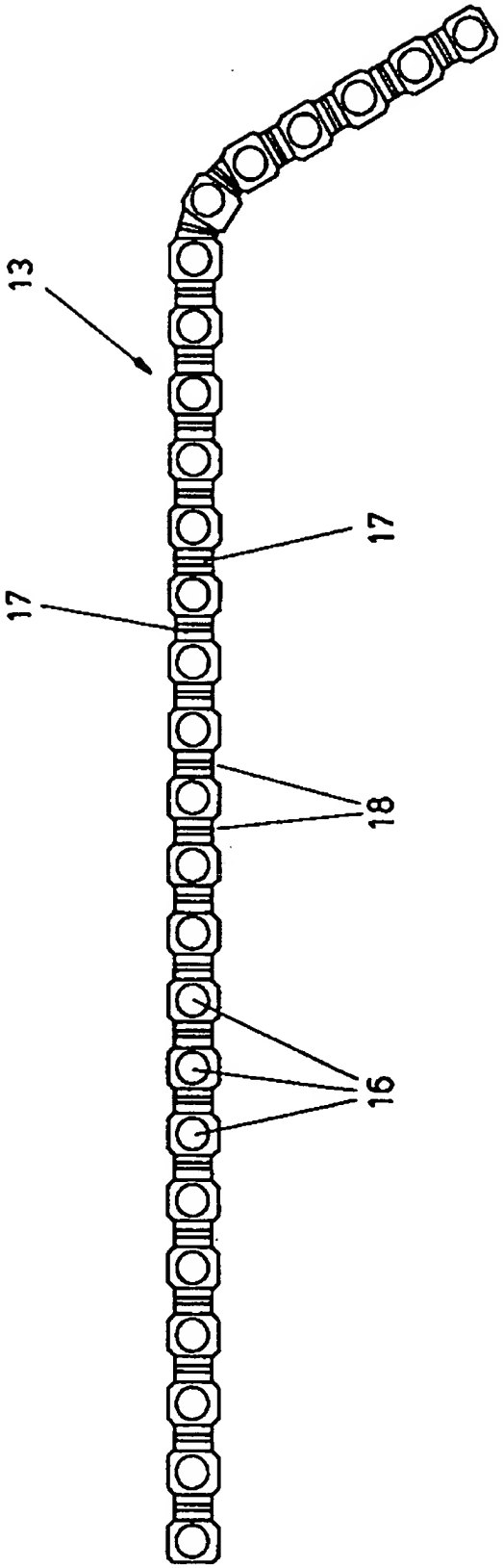

FIG. 8A

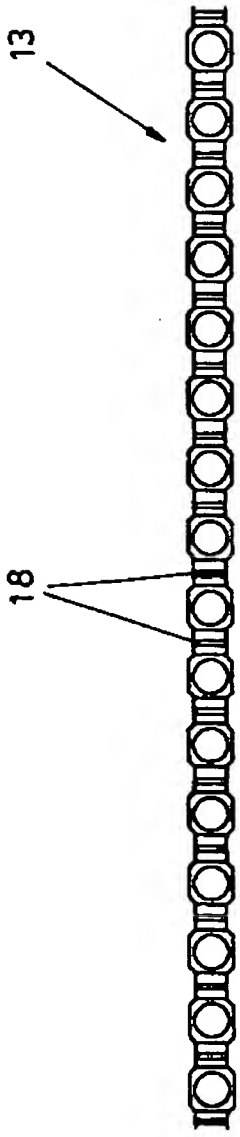

FIG. 8B

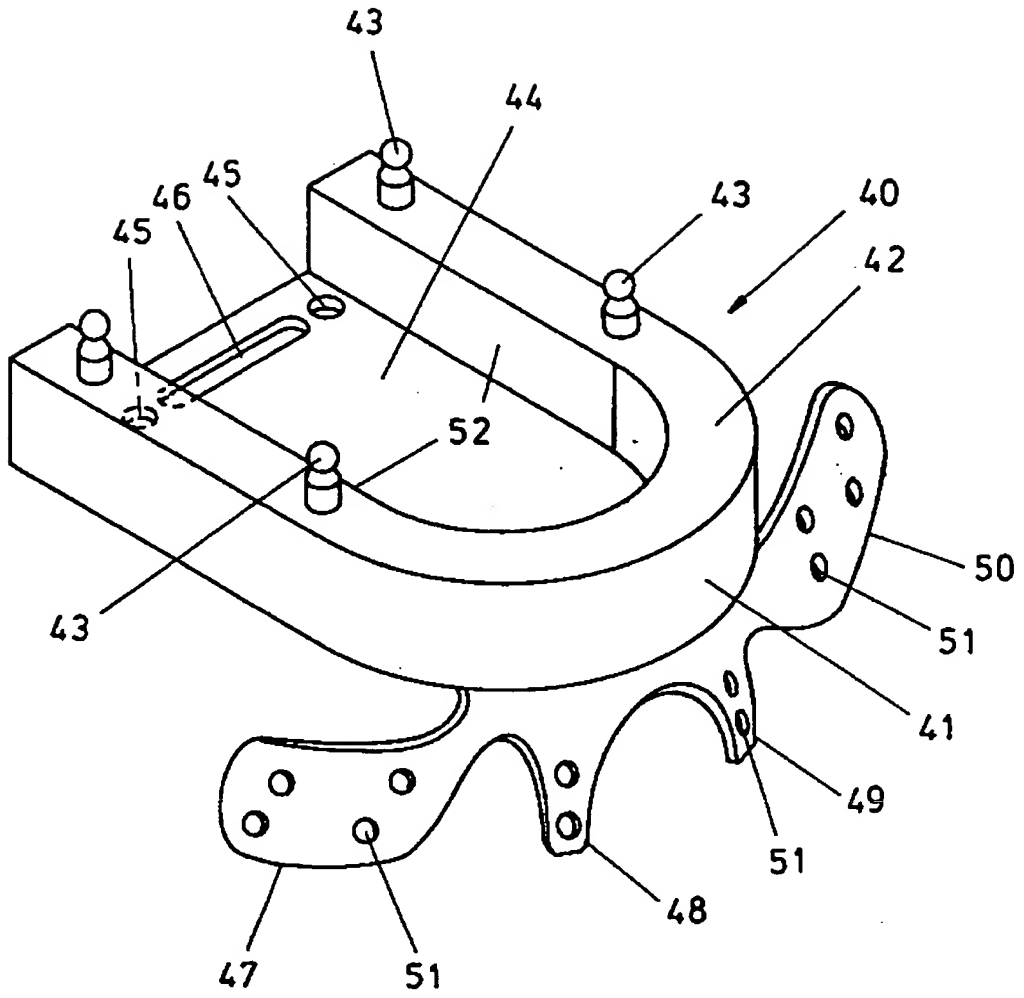

FIG. 9

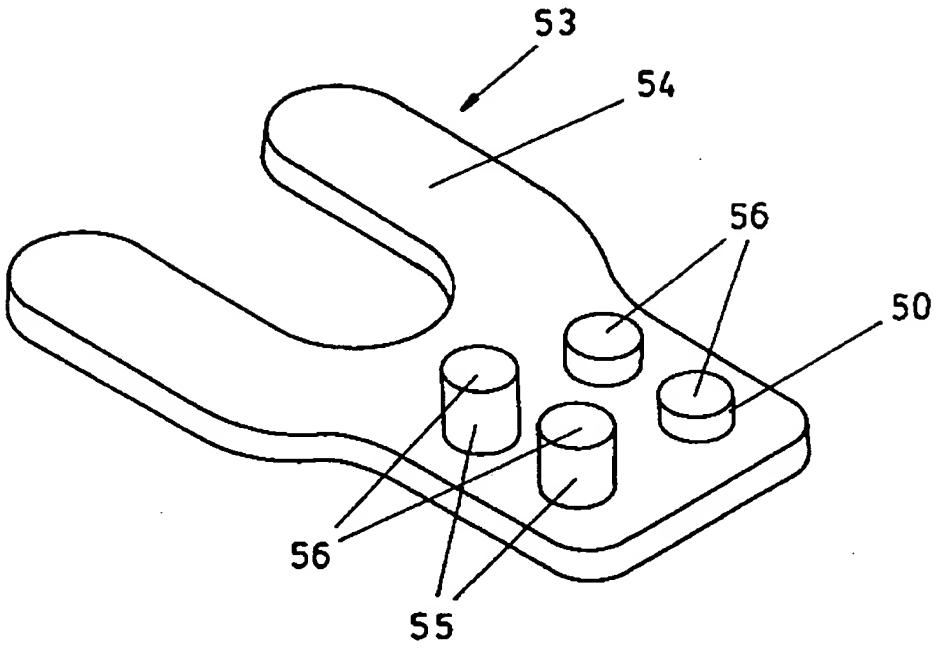

FIG. 10

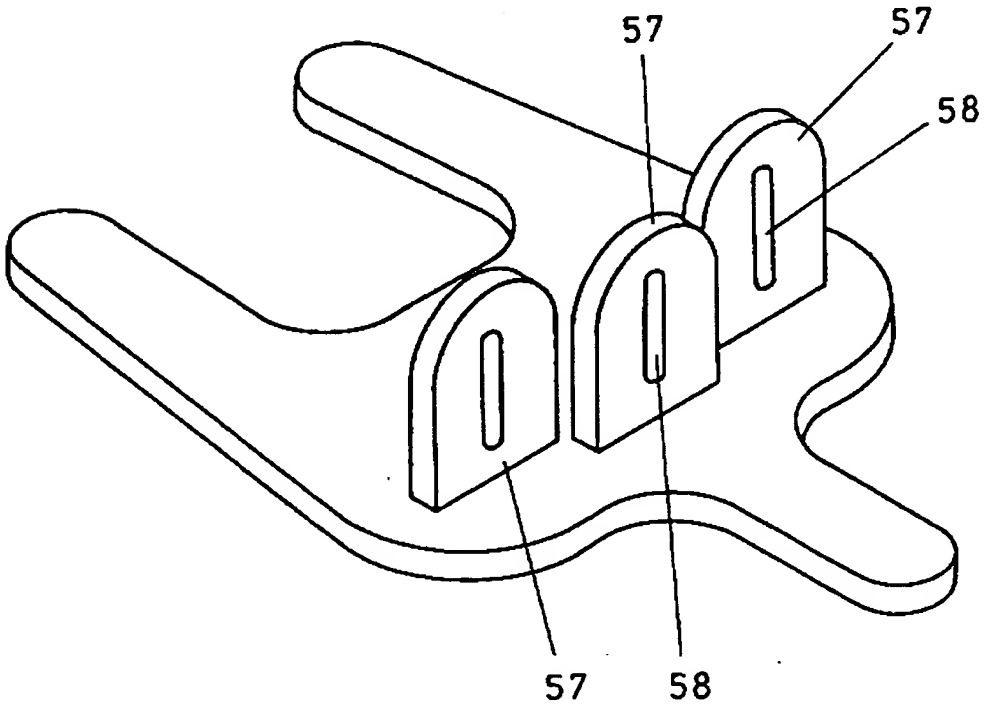

FIG. 11

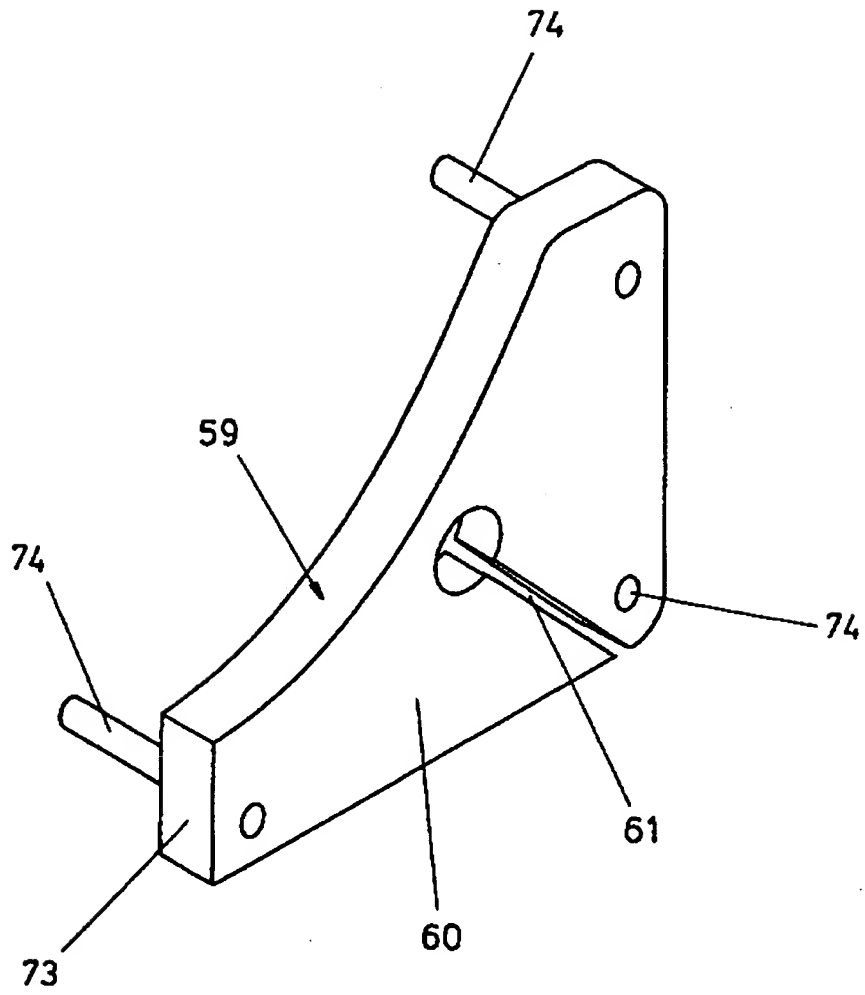

FIG. 12

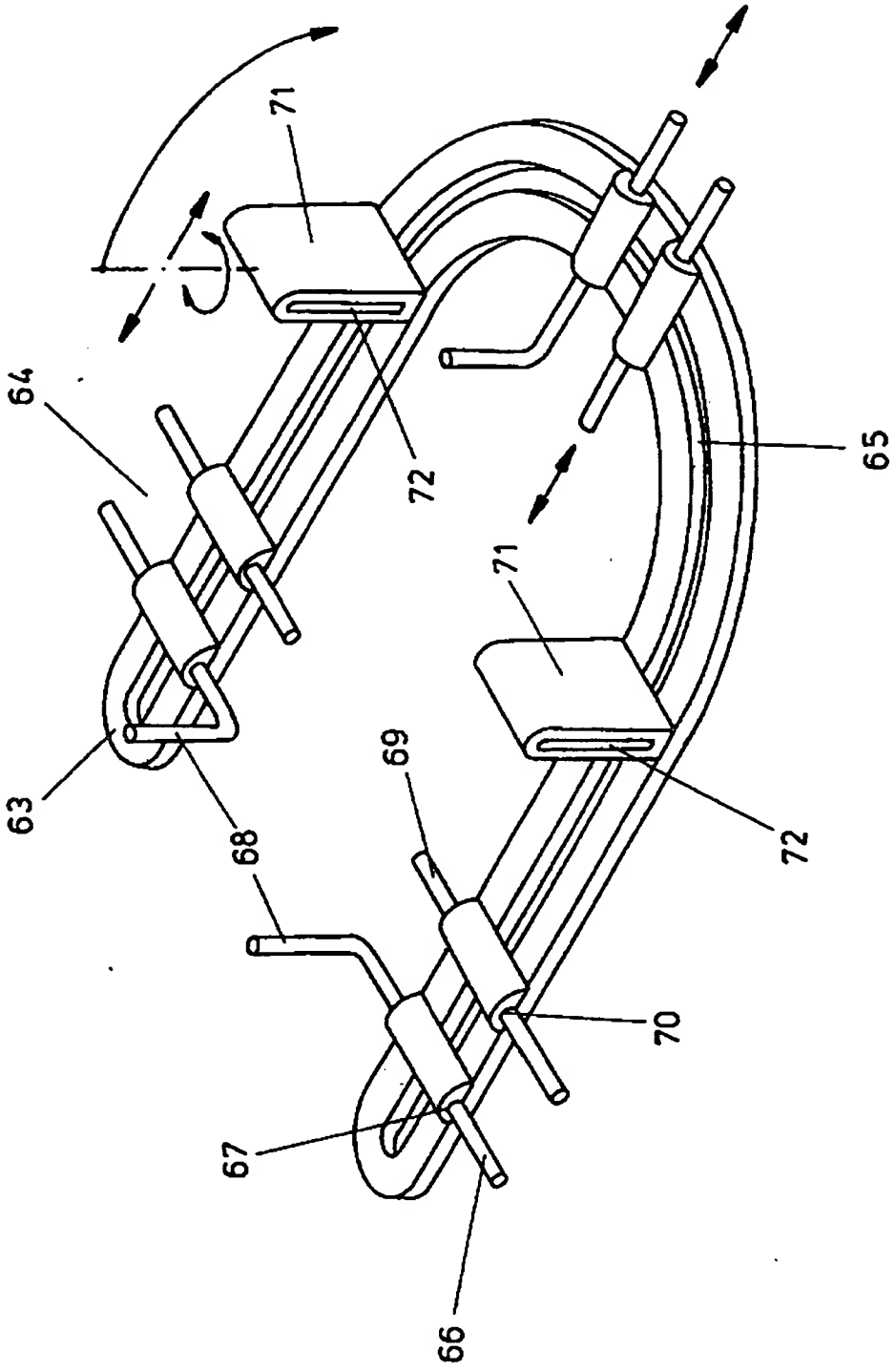

FIG. 13

PROSTHETIC IMPLANTS

The present invention relates to a method of making a prosthetic implant, a prosthetic implant, a prosthetic implant for inclusion in the mouth region of a patient, a method of joining one part of a prosthetic implant to another part of an implant, an attachment means adapted to attach a prosthetic implant to a bone, a method of attaching a prosthetic implant to a bone, a prosthetic implant, a dental prosthetic implant and a method of making a dental prosthetic implant. The invention is particularly, although not exclusively, applicable to prosthetic implants for use in the lower and upper jaw.

At present, when a patient requires to have a part of a lower or upper jaw replaced, the jaw is opened up and the relevant portion of bone is removed. A plate is then attached to span a part of the jaw which has been removed with the plate being attached at either side to the remaining bone. The remaining part of the gap that has been created by removing the bone is then filled in with bone from another part of the body together with muscle from another part of the body. The operation is of long duration and the recovery time of the patient is considerable. Furthermore, there are difficulties in attaching the plate to the bone and difficulties in getting an effective tooth located in the region where the bone has been removed from.

It is an object of the present invention to attempt to overcome at least some of the above described disadvantages.

According to one aspect of the present invention a method of making a prosthetic implant comprises scanning

a part of the bone structure of a patient and building up a three dimensional image of the bone structure, calculating the portion of the bone structure that is to be replaced by the implant, and making the implant substantially to the desired shape that the bone should have.

The method may comprise calculating the shape of the implant by reviewing the shape of another part of the bone structure of a patient that does not require replacement.

The method may comprise using the three dimensional image in order to form the desired shape of the implant.

The implant may include means for mounting teeth thereon. The means for mounting teeth thereon may be integrally formed on the implant.

The implant may include a fastening member attached thereto or integrally formed therewith arranged, in use, to attach the implant to bone. The fastening member may be arranged to be attached to the implant before the implant is located in the bone structure of a patient. The fastening member may be arranged to be attached to the bone structure of a patient at two or more spaced locations. Those spaced locations may be either side of a location that the implant is arranged to occupy.

According to a further aspect of the present invention a prosthetic implant for use in a bone structure is characterised in that the implant corresponds substantially to the desired shape that the bone that the implant is replacing should have.

The implant may include variations in depth and, alternatively or additionally, in width along its extent. The surface of the implant may include variations in angle along its extent.

The implant may include an attachment for teeth thereon and that attachment may be integrally formed on the implant. The implant may include means for attaching a further implant and that further implant may comprise dentures.

According to another aspect of the present invention a prosthetic implant for inclusion in the mouth region of a patient comprises a shaped portion arranged to take the place of bone that requires replacement with the implant including a dental attachment portion.

The dental attachment portion may be integral with the implant.

According to a further aspect of the present invention a method of joining one part of an implant to another comprises locating a connecting member to extend from one part of the implant through the other part of the implant and enlarging the end of the connecting member to prevent the return of the connecting member back through the part of the implant through which it extends by applying an increasing force to the end of the connecting member to cause the dimension of the connecting member to increase in a direction transverse to its extent through the part of the implant through which it extends.

The method may comprise preventing the opposite end of the connecting member to that end which is enlarged

from moving relative to the other end when the force is applied.

The method may comprise causing the connecting member to extend through both parts of the implant.

The end of the connecting member that is caused to increase in dimension may include a recess and the method may comprise engaging that recess by a force applying member with the recess and the force applying member having cooperating portions that extend at an angle to the line of applied force to cause the dimension of the connecting member to increase as the force is increased.

According to a further aspect of the present invention connecting apparatus for use in a method of joining one part of a prosthetic implant to another, which implant is as herein described, comprises a fixed part and an opposed part movable relative to the fixed part whereby, when the parts move relative to each other towards each other the dimension of a member connecting one part of an implant member to another is arranged to be increased in a direction transverse to the direction of relative movement.

According to a further aspect of the present invention attachment means are provided that are adapted to attach an implant to a bone, the attachment means comprising a first bone engaging portion arranged to extend into, and be connected to a bone and a second implant engaging portion adapted to engage with an implant, the second portion being arranged to extend through an opening in the implant into the bone in a first direction, the second portion being arranged to bind

against the opening in an implant by being expanded in a second direction, transverse to the first direction.

The second direction may be perpendicular to the first direction.

The second portion may comprise at least two parts that are separate from each other in the second direction but connected to each other at a spaced location in the first direction that are capable of moving away from each other.

The attachment means may comprise an operating member adapted to cooperate with the second portion in order for the second portion to be expanded. The operating member may be located at least partially, and preferably substantially within the second portion. The operating member may threadably engage the second portion.

The first portion may be arranged to threadably engage with a bone.

According to another aspect of the present invention a method of attaching an implant to a bone comprises engaging the implant with a bone by engaging a portion of attachment means with the bone, the attachment means extending through the implant, and subsequently expanding the attachment means in a direction transverse to the direction in which the attachment means extends through the opening in the implant to cause the attachment means to bind against the opening.

The method may comprise screwing the engaging portion into the bone.

The method may comprise forcing two parts of the attachment means away from each other in order to expand and bind the attachment means to the implant.

According to another aspect of the present invention a dental prosthetic implant that is adapted to receive a tooth is characterised in that the dental implant is arranged to be connected to a further implant.

The dental implant may include at least one opening through which a connecting member may be arranged to extend to attach the dental implant to the further implant.

According to a further aspect of the present invention a method of attaching a dental prosthetic implant comprises attaching the dental implant to another implant.

The method may comprise attaching the dental implant to the other implant when the other implant is connected to the bone of a patient.

According to a still further aspect of the present invention a surgical saw guide arrangement includes an abutment surface arranged, in use, to be held against a part to be cut and a guide fixed in position relative to the abutment surface with the guide, in use, being arranged to be cooperated with by a saw in order to guide the saw during cutting.

The arrangement may include a further surface opposed to the abutment surface which further surface is arranged, in use, to be engaged by an operator to hold the abutment surface in place.

At least part of the arrangement, which may comprise part of the abutment surface, may be shaped to conform to part of the shape of the part to be cut.

The arrangement may comprise locating the guide at the precise location that the cut is to be made. The guide may be fast with, or integral with the abutment surface. Alternatively, the guide may be adjustable relative to the abutment surface, and the adjustment of the guide relative to the abutment surface may comprise sliding adjustment or angular adjustment or both. The arrangement may include securement means arranged to secure a guide in place to prevent adjustment.

The guide may comprise an abutment surface against which a saw, in use, is arranged to move when effecting the cut. The guide may comprise a slot through which a saw is arranged to move when effecting the cut and the slot may be formed in part of the abutment surface. The slot may be closed at both ends.

The arrangement may include a plurality of guides.

The arrangement may include at least one location member arranged, in use, to cooperate with the part to be cut to resist relative sliding movement of the abutment surface and the part to be cut in at least one relative direction.

The position of the location member relative to the abutment surface may be adjustable.

The arrangement may include a plurality of location members and the location members may be arranged to resist

relative rotation of the part to be cut and the abutment surface in at least one relative direction.

The present invention includes any combination of the herein referred to features or limitations.

The present invention may be carried into practice in various ways, but several embodiments will now be described, by way of example, and with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view showing a lower jaw 10 having a damaged region 11 for replacement;

Figure 2 is a front view of Figure 1;

Figure 3 is a view similar to Figure 1 including an implant 12 in place of the damaged region;

Figure 4 is a front view of Figure 3;

Figure 5 is a schematic sectional view showing how a Thorpe plate 13 is attached to the remaining bone 14 in a jaw;

Figure 6 is a schematic side view showing how the Thorpe plate 13 is attached to the implant 12,

Figures 7A and 7B are a side and a front view respectively showing a dental implant 15 for attachment to a Thorpe plate 13;

Figures 8A and 8B are a side view and a plan view of a Thorpe plate 13, and

Figure 9 is an underneath perspective view of a greater maxilla implant;

Figure 10 is a schematic perspective view of a horizontal jig that is used when cutting and removing bone prior to an implant replacing the removed bone;

Figure 11 is a schematic perspective view of a vertical cutting jug;

Figure 12 is a schematic perspective view of a saw guide for use in cutting a mandible, and

Figure 13 is a schematic perspective view of a further saw guide for use in cutting a mandible.

In a surgical procedure it is desired to replace the damaged portion 11 of the lower jaw, shown in Figures 1 and 2, with an implant. The portion 11 may have been damaged in an accident or may comprise diseased bone.

In a known manner the patients jaw is scanned and details of the cross section of the relevant area are built up in planes that are 0.25 mm in depth. That information is stored in a computer. A bath of liquid resin then has laser light directed at its upper surface. Initially the laser scans the resin of the lowermost layer to reproduce the shape of the lower scanned layer of the bone. As the resin is light sensitive, the portion that is scanned hardens. A base located just beneath the top surface of resin is then lowered to allow liquid resin to a depth of 0.25 mm to flow over the previously hardened layer. The next layer is then scanned to harden that layer of resin to the shape dictated before the base is lowered again and so on until the complete shape of bone

that is required is built up. That bone may comprise the lower jaw only or may comprise the complete skull.

If the bone that is to be removed is misshapen, for instance as a result of a tumour, the desired shape can be determined by viewing another part of the jaw that is not damaged.

A surgeon then determines where is the best place in the jaw to make the desired cuts by viewing the resin model, and the implant 11 can then be made to that shape, by using parts of the computer stored scan that make up the layers of the part to be removed. The implant will be made of titanium to the desired shape of the part that is to be replaced.

A surgeon can then practice on the resin model by making the cuts in the desired places and fitting the implant in non-sterile conditions. When the surgeon is content then the implant can be sterilised and the operation can be performed on the patient without, hopefully, there being any unexpected complications as the surgeon will know where to cut the bone and the surgeon will know that the implant will fit. It is not necessary with this operation to graft bone and muscle from elsewhere and neither is it necessarily the case that important blood vessels and nerves be severed when performing the operation. Accordingly the gum and tissue surrounding the bone can be cut away in a flap. The bone can be removed, the implant attached and the gum and tissue moved back into place. Thus operating time and recovery time are reduced significantly with less risk to the patient and a greater chance of conventional jaw function, including speech and eating function, being able to be achieved.

In order to attach the implant to the bone a Thorpe plate 13, shown in Figures 8A and 8B is used. This plate comprises an elongate plate of metal such as titanium. A series of holes 16 are formed at evenly spaced distances along the plate. The plate is of reduced cross-section, as indicated at 17, between the holes when viewed from the side, and also of reduced cross-section, as indicated at 18, between the holes when viewed in plan. Accordingly the plate can be bent in a suitable jig to correspond with the shape of a jaw either up or down or from side to side, as can be seen in Figures 3 and 4.

The plate 13 is attached to the insert 12 in non sterile conditions, and the plate is bent to the required shape and cut to the desired length also under those conditions.

Figure 6 shows the manner in which the plate 13 is attached to the implant 12. Holes are made or formed in the implant that align with the holes 16 on the plate 13. The plate and the implant are then placed in a jig 19 with a rivet 20 passing through both parts.

The rivet 20 includes an enlarged head 21 that rests against the plate 13 with the shank of the rivet passing through the plate and implant with a remote end of the rivet standing proud of the implant at the other side to the plate and having a cylindrical opening 22 in its exposed end.

The head 21 includes a small recess that allows an anvil 23 at one side of the jig to locate and abut that head. At the other side of the jig a conical end 24 to a screw 25 is wound up by turning an operating end 26 of the screw to cause the conical end 24 to extend into the

cylindrical opening of the rivet. Turning of the screws causes threads on the screw and in the jig to cooperate to cause this translational movement. Further turning of the operating end 26 causes the sides of the conical member to bear against the cylindrical opening 22 of the rivet to push the ends of the rivet outwardly to cause the projecting end of the rivet to be larger than the opening in the implant 12 to thereby hold the implant and the plate together. Rivets can be attached in this manner at desired locations along the coextent of the plate and insert.

With the implant and plate attached and sterilised, and with the relevant portion of the bone removed, the implant can then be attached to the bone.

Conventional methods of attaching a Thorpe plate to the bone have comprised drilling and tapping the bone and then driving a screw through an opening into the plate to hold the plate against the bone. However, after a time the bone relaxes its grip on the screw and, because of the tension holding the screw in place, the screw can lose its tension and the plate can become loose.

Figure 5 shows the apparatus for securing the plate 13 against the bone 24. The bone is drilled and tapped as shown at 27. A threaded screw 28 is then located through the plate and turned to drive the screw into the bone. The free end of the screw is provided with an allen key recess 29 to enable the screw to be so turned.

With the screw connected to the bone to a sufficient extend a threaded bolt 30 is then screwed into a threaded opening 31 at the free end of the screw. The bolt 30 thus enters the screw and, when an outwardly diverging cone 31

of the screw engages a conical recess of the screw, the end of the screw, which is separated by opposed slits 33, is urged outwardly to bind the screw radially outwardly against the radially inwardly facing wall of the hole 16 of the plate.

Accordingly there is no axial force urging the plate against the bone and the bolt will not tend to be pulled out of the threaded opening in the bone.

As the screw is countersunk, the end of the bolt may be generally flush with the end of the screw. As no head of the screw has to bear against the outer surface of the plate, the end of the screw may be generally flush with the outer surface of the plate.

The insert 12 is provided with integral pegs 34 onto which false teeth can be fitted. These pegs 34 are known as Brannamark implants and they allow a false tooth to be snap fitted over the ball of the implant. Once the operation to secure the implant is complete, the area of gum around the implant can be cleared and false teeth fitted, possibly within a week of the operation to include the insert having been completed.

Figures 7A and 7B show a dental implant 15 that can be attached to a plate 13. The implant includes spaced openings 35 that are aligned with the openings 16 in a plate 13. The implant can be attached to the plate by means of rivets, as described in relation to Figure 6, or by other means, either before or after the implant is included in the bone of a patient. This type of implant though will more commonly be used for patients that have a plate 13 already incorporated in their fixed structure.

The implant 15 is recessed at 36 to stop the fastener projecting, or projecting unduly from the implant.

Figure 9 shows, from the underneath, a greater maxilla implant 40. The implant is made to the shape shown in the manner previously described for the other embodiments.

The implant 40 includes a main horseshoe shaped section 41 to the undersurface 42 of which are secured dental fixation pegs 43. A plate 44 extends across the upper surface of the section 41 with that plate being provided with spaced holes 45 between which a slot 46 also extends. A soft pallet attachment (not shown) can be attached to the plate 44 via the holes 45 and the slot 46.

A series of bone plates 47, 48, 49 and 50 extend upwardly from the rear of the implant and these plates are used to attach the implant to the greater maxilla via screws or attachment devices extending through openings 51.

The inwardly facing surfaces 52 of the horseshoe shaped section, at the forward end are parallel to each other to assist in the attachment of dentures at the front of the mouth after the implant has been secured to a patient.

The whole implant may be formed from a single piece of metal, such as titanium. Alternatively the implant may be made up from separate pieces that are joined or connected together.

Figures 10 to 13 show the apparatus that can be used to allow accurate and straight cuts to be made in the bone

plates 57, each of which has a vertical slit 58 extending therethrough.

In order to make a cut, a saw blade is fed through the slots and reciprocated to make the required vertical cut through the bone. In practice, the surgeon may cut the first 10 or 15 mm of bone whilst using the jig, and then remove the jig in order to complete the cuts with those initial cuts serving to locate and guide the saw through the remainder of the cut.

The plates 57 are located on the jig after having determined, on the resin mould, exactly where the vertical cuts are required.

Figure 12 shows a jig 59 that is used when making a cut on a mandible. The jig comprises a plate 60 that is shaped according to the individual shape of the mandible to be cut. A slit 61 is formed in the plate 60 along the plane that the cut is to be made. When making the cut, the saw blade moves through the slit as it cuts the bone. When a significant length of bone has been cut through, the guide can be removed in order that the cut can be completed.

The plate 60 includes three locating pins 74 that cooperate with the jaw to locate the jig in exactly the correct position (which again is assisted by being able to locate those pins on the resin model before the operation) with the pins abutting with the jaw to prevent relative rotation of the jig whilst the surgeon is making the initial cut.

The end face 73 of the plate can also be used as a saw guide, if required.

Figure 13 is a mandible saw guide that is arranged to be brought into contact from beneath the mandible such that a horseshoe 63 surrounds the mandible and is spaced slightly therefrom. The saw guide 64 shown in Figure 13 is arranged to be adapted to be used on a variety of different sized mandibles from different patients. However, as described before, the guide can be set up on the resin mould before being brought into the operating theatre.

The guide includes a slot 65 that extends between the ends of the horseshoe such that the upper and lower sides of the horseshoe can form clamping surfaces or attachment surfaces for various articles.

Both sides and the end of the horseshoe include lateral profile setting rods 66 that are slidable through mounting channels 67 through those channels such that the orientation of the upwardly extending end 68 of the rods can be altered. The upwardly extending ends of the rods cooperate with the inwardly facing surface of the mandible to ensure accurate location.

Adjacent to each of the rods that extend upwardly are straight rods 69 that can move through channels 70 in the direction of those channels. Those straight rods 69 can be used to abut the outwardly facing surface of the mandible. The rods 69 can be pre-set, before the guide is brought into position. Alternatively, when the guide is in position, the rods can be moved forward to the interior of the horseshoe to cause the final setting of the guide.

Two adjustable saw guide blocks 71 are also mounted on the horseshoe. These saw guides include slots 72 that extend through their central portion such that the cut can

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A method of making a prosthetic implant comprising scanning a part of the bone structure of a patient and building up a three dimensional image of the bone structure, calculating the portion of the bone structure that is to be replaced by the implant, and making the implant substantially to the desired shape that the bone should have.

2. A method as claimed in Claim 1 comprising calculating the shape of the implant by reviewing the shape of another part of the bone structure of a patient that does not require replacement.

3. A method as claimed in Claim 1 or Claim 2 comprising using the three dimensional image in order to form the desired shape of the implant.

4. A method as claimed in any preceding claim in which the implant includes means for mounting teeth thereon.

5. A method as claimed in Claim 4 in which the means for mounting teeth thereon are integrally formed on the implant.

6. A method as claimed in any preceding claim in which the implant includes a fastening member attached thereto or integrally formed therewith arranged, in use, to attach the implant to bone.

7. A method as claimed in Claim 6 in which the fastening member is arranged to be attached to the implant before the implant is located in the bone structure of a patient.

8. A method as claimed in Claim 6 or 7 in which the fastening member is arranged to be attached to the bone structure of a patient at two or more spaced locations.

9. A method as claimed in Claim 8 in which those spaced locations may be either side of a location that the implant is arranged to occupy.

10. A prosthetic implant for use in a bone structure characterised in that the implant corresponds substantially to the desired shape that the bone that the implant is replacing should have.

11. An implant as claimed in Claim 10 in which the implant includes variations in depth and, alternatively or additionally, in width along its extent.

12. An implant as claimed in Claim 10 or 11, in which the surface of the implant includes variations in angle along its extent.

13. An implant as claimed in any of Claims 10 to 12 in which the implant includes an attachment for teeth thereon.

14. An implant as claimed in Claim 13 in which the attachment is integrally formed on the implant.

15. An implant as claimed in any of Claims 9 to 13 in which the implant includes means for attaching a further implant and that further implant may comprise dentures.

16. A prosthetic implant for inclusion in the mouth region of a patient comprising a shaped portion arranged

to take the place of bone that requires replacement with the implant including a dental attachment portion.

17. An implant as claimed in Claim 16 in which the dental attachment portion is integral with the implant.

18. A method of joining one part of an implant to another comprising locating a connecting member to extend from one part of the implant through the other part of the implant and enlarging the end of the connecting member to prevent the return of the connecting member back through the part of the implant through which it extends by applying an increasing force to the end of the connecting member to cause the dimension of the connecting member to increase in a direction transverse to its extent through the part of the implant through which it extends.

19. A method as claimed in Claim 18 comprising preventing the opposite end of the connecting member to that end which is enlarged from moving relative to the other end when the force is applied.

20. A method as claimed in Claim 19 comprising causing the connecting member to extend through both parts of the implant.

21. A method as claimed in Claim 20 or 21 in which the end of the connecting member that is caused to increase in dimension includes a recess and the method may comprise engaging that recess by a force applying member with the recess and the force applying member having cooperating portions that extend at an angle to the line of applied force to cause the dimension of the connecting member to increase as the force is increased.

22. Connecting apparatus for use in a method of joining one part of a prosthetic implant to another, which implant is as herein described, comprises a fixed part and an opposed part movable relative to the fixed part whereby, when the parts move relative to each other towards each other the dimension of a member connecting one part of an implant member to another is arranged to be increased in a direction transverse to the direction of relative movement.

23. Attachment means are provided that are adapted to attach an implant to a bone, the attachment means comprising a first bone engaging portion arranged to extend into, and be connected to a bone and a second implant engaging portion adapted to engage with an implant, the second portion being arranged to extend through an opening in the implant into the bone in a first direction, the second portion being arranged to bind against the opening in an implant by being expanded in a second direction, transverse to the first direction.

24. Means as claimed in Claim 23 in which the second direction may be perpendicular to the first direction.

25. Means as claimed in Claim 23 or 24 in which the second portion comprises at least two parts that are separate from each other in the second direction but connected to each other at a spaced location in the first direction that are capable of moving away from each other.

26. Means as claimed in any of Claims 23 to 25 in which the attachment means comprises an operating member adapted to cooperate with the second portion in order for the second portion to be expanded.

27. Means as claimed in Claim 24 in which the operating member is located at least partially, and preferably substantially within the second portion.

28. Means as claimed in Claim 26 or 27 in which the operating member threadably engages the second portion.

29. Means as claimed in any of Claims 23 to 28 in which the first portion is arranged to threadably engage with a bone.

30. A method of attaching an implant to a bone comprising engaging the implant with a bone by engaging a portion of attachment means with the bone, the attachment means extending through the implant, and subsequently expanding the attachment means in a direction transverse to the direction in which the attachment means extends through the opening in the implant to cause the attachment means to bind against the opening.

31. A method as claimed in Claim 30 comprising screwing the engaging portion into the bone.

32. A method as claimed in Claim 30 or 31 comprising forcing two parts of the attachment means away from each other in order to expand and bind the attachment means to the implant.

33. A dental prosthetic implant that is adapted to receive a tooth is characterised in that the dental implant is arranged to be connected to a further implant.

34. An implant as claimed in Claim 33 in which the dental implant includes at least one opening through which a

connecting member may be arranged to extend to attach the dental implant to the further implant.

35. A method of attaching a dental prosthetic implant comprising attaching the dental implant to another implant.

36. A method as claimed in Claim 35 comprising attaching the dental implant to the other implant when the other implant is connected to the bone of a patient.

37. A surgical saw guide arrangement includes an abutment surface arranged, in use, to be held against a part to be cut and a guide fixed in position relative to the abutment surface with the guide, in use, being arranged to be cooperated with by a saw in order to guide the saw during cutting.

38. An arrangement as claimed in Claim 37 including a further surface opposed to the abutment surface which further surface is arranged, in use, to be engaged by an operator to hold the abutment surface in place.

39. An arrangement as claimed in Claim 37 or 38 in which at least part of the arrangement, which may comprise part of the abutment surface, may be shaped to conform to part of the shape of the part to be cut.

40. An arrangement as claimed in any of Claims 37 to 39 comprising locating the guide at the precise location that the cut is to be made.

41. An arrangement as claimed in Claim 40 in which the guide is fast with, or integral with the abutment surface.

42. An arrangement as claimed in Claim 40 in which the guide is adjustable relative to the abutment surface, and the adjustment of the guide relative to the abutment surface may comprise sliding adjustment or angular adjustment or both.

43. An arrangement as claimed in any of Claims 40 to 42 in which the arrangement includes securement means is arranged to secure a guide in place to prevent adjustment.

44. An arrangement as claimed in any of Claims 37 to 43 in which the guide comprises an abutment surface against which a saw, in use, is arranged to move when effecting the cut.

45. An arrangement as claimed in Claim 44 in which the guide comprises a slot through which a saw is arranged to move when effecting the cut and the slot may be formed in part of the abutment surface.

46. An arrangement as claimed in any of Claims 37 to including a plurality of guides.

47. An arrangement as claimed in any of Claims 37 to 46 including at least one location member arranged, in use, to cooperate with the part to be cut to resist relative sliding movement of the abutment surface and the part to be cut in at least one relative direction.

48. An arrangement as claimed in Claim 47 in which the position of the location member relative to the abutment surface may be adjustable.

49. An arrangement as claimed in Claim 48 including a plurality of location members and the location members may

be arranged to resist relative rotation of the part to be cut and the abutment surface in at least one relative direction.

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The Patent Office

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Claims searched: 1-17 **Date of search:** 5 August 1998

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): A5R (RAG, RAP)

Int Cl (Ed.6): A61F 2/28, 2/30

Other: -

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
E, X	GB 2318058 A	(PECKITT) see the claims	1,3-10, 13-17
X	EP 0255797 A1	(MECRON) see WPI abstract	1-3,10
X	WO 96/05038 A1	(UNIV. OF TEXAS) see p.22 l.28 - p.23 l.3	1-3,10
X	WO 95/15131 A1	(EUFINGER ET AL.) see the abstract	1-3,10
X	WO 95/07509 A1	(UNIV. OF QUEENSLAND) see p.7 l.5 - p.9 l.13 and p.10 ll.1-3	1-3,6-11
X	US 5370692	(FINK ET AL.) see the abstract and col.6 ll.11-61	1-3,10
X	US 5156777	(KAYE) see whole document	1-3,10
X	US 4436684	(WHITE) see col.2 ll.3-30 and col.5 ll.34-39	1-3,10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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